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TECHNICAL REPORT
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2ND INTERNATIONAL CONGRESS FOR RESEARCH IN BURNS, EDINBURGH, SCOTLAND, 20-24 SEPTEMBER 1965

BY

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2ND INTERNATIONAL CONGRESS FOR RESEARCH IN BURNS, EDINBURGH, SCOTLAND, 20-24 SEPTEMBER 1965

The welcome in Edinburgh compensated for the 1½-hour unscheduled wait in the overcrowded departure lounge at London Airport. A representative of the local organizing committee was on hand in Edinburgh to direct delegates to the chartered bus for the drive to the Univ. of Edinburgh. After completing the registration procedures in the new, modern David Hume Tower and having tea, we were driven to our accommodations.

At least 42 nations were represented by more than 300 delegates. Many wives were registered as associates. The Organizing Committee, with Mr. Alister B. Wallace as Chairman, had obviously spent many hours to make the Congress run smoothly. The professional and social programs for delegates and associates were very well organized.

There were a total of 13 separate scientific sessions and two general business meetings. A total of 74 papers was scheduled, but six had to be withdrawn and two substitutions were added. An additional 80 papers were accepted by title. The Proceedings of the Second International Congress of Research in Burns, edited by Wallace and Wilkinson, will be published by E. & S. Livingstone, Ltd., Teviot Place, Edinburgh at an anticipated cost of £3.10.0. (approx. $10.00) and will present in detail the papers submitted at the Congress.

The first day was divided into four consecutive sessions with a total of 20 papers.

Treatment of renal failure in burns, by Dr. J.S. Cason (Medical Research Council Burns Unit, Birmingham Accident Hospital, Bath Row, Birmingham, England). Renal failure may be oliguric but not necessarily. Mannitol in 15% concentration, given rapidly on a basis of 1 g/kg body weight early after injury involving 30% of the body surface, usually produces diuresis. In an alternate series of 20 patients, there have been three deaths; two of ten receiving mannitol and one of ten not receiving the infusion. The treatment is otherwise standard and includes a 30-40 g protein diet. Dialysis is routinely performed when the blood urea reaches a level of 150 mg %. It is obvious that more time is needed to evaluate the role of intravenous mannitol in treatment of renal failure due to burns.

Studies on the mechanism and treatment of acute oliguria in the burned dog, by Dr. G. Barac (Hôpital de Bavière, Liège, Belgium). Anesthetized dogs subjected to standard cutaneous thermal burns rapidly became oliguric or even anuric in spite of maintenance of normal systemic blood pressure. The author perfused kidneys, both in situ and homotransplanted to the neck, with blood from normal and burned donors and concluded that the renal impairment was of humoral origin. Further investigations suggested that a part of the toxic factor was from red blood cells. It was stated that some diuretics are effective in the acute oliguria due to burns and that sodium ascorbate can "unblock anuric kidneys."

Resuscitation and renal function, by Prof. A.W. Wilkinson (Hospital for Sick Children, Great Ormond St., London). A therapeutic regimen using less fluid (6% Dextran in 1.9% saline, whole blood and dextran) than that based on the formula of 1 ml/% surface injury/kg was used in selected patients with renal impairment. In 20% surface injuries, 40% of the calculated fluids was used; in 20-40% injuries, 80% of the volume was administered, and in 40-65% burns, the calculated amount was given to the small group of children ranging from two days to 13 years of age. Wilkinson emphasized that in these young patients, the urine volume was not closely related to the volume of fluids administered.

The use of hyperbaric oxygen in burns, by Prof. G. Smith (22 Rubislaw Den North, Aberdeen, Scotland). Guinea pigs were subjected to body burns prior to affixing a small chamber for supplying oxygen under increased pressure. A known dose of Ps. pyocyaneus was applied to the wound and the area was then subjected to hyperbaric oxygen. Data on subsequent quantitative estimates of contamination support the bacteriostatic effect of hyperbaric oxygen.

The fire hazard to man of oxygen rich environment, by Flt. Lt. D. Denison, RAF (RAF Inst. of Aviation Medicine, Farnborough, England). Denison showed a part of the dramatic film demonstrating flash burning of skin in spite of protective clothing, unless the clothing was of a tight-fitting, mesh design. Automatic sprinkler devices must function rapidly and with adequate flow to aid in preventing flash burns.

Protein and colloid solutions in burns treatment, by Dr. C.R. Rickets (MRC Burns Unit, Birmingham Accident Hospital, Bath Row, Birmingham). A stabilized plasma protein fraction (PPF) and an improved, high molecular weight dextran solution have been used at the MRC Burns Unit with apparently satisfactory results. The new dextran solution apparently is not associated with increased rouleaux formation. Since the PPF does not contain gamma globulin, supplementary gamma globulin is administered to aid in preventing infection. These two products are expected to become widely available in the near future.

The treatment of burn shock with oral-saline-bicarbonate solution, by Mr. D.M. Jackson (Birmingham Accident Hospital, Birmingham). The use of oral solution containing 3 g sodium chloride and 1.5 g sodium bicarbonate/liter in the treatment of burn shock was evaluated for use when intravenous fluids are not available or cannot be used. Jackson reported that the majority of burns under 25-30% could be treated satisfactorily but that the care and observation required were not diminished. If shock was not controlled, the total volume of colloids required was usually reduced.

The use of amine buffer in the resuscitation of the severely burned patient, by Dr. L.M. Cramer (Univ. of Rochester School of Medicine & Dentistry, Rochester, N.Y.). The intravenous administration of trihydroxyaminomethane (TRIS) is said to promptly reverse the metabolic acidosis present during burn shock. This buffer solution (36 g TRIS/l) also produces an osmotic diuresis and clears hemoglobinuria. Cramer recommends infusing one liter over a 2½-3 hr period and has encountered no hypoglycemia, no hypokalemia, and no respiratory arrest in his series.

Quantitative changes in capillary filtration, diffusion and permeability in experimental burns, by Dr. G. Arturson (Plastikkirurgiska Kliniken, Akademiski Sjukhuset, Uppsala, Sweden). The "leakage" of different molecular sizes from blood to lymph was determined by a technique using dextran for the capillary "sieving" measurements. A quantitative, continuous registration of vessel resistance, trans-capillary fluid movement and estimation of the "filtration coefficient" (ml. fluid filtered in 1 min/100 g tissue/mm Hg trans-capillary pressure gradient) was made by using a water-filled plethysmograph. A rapid trans-capillary movement of fluid from the bloodstream into the tissue occurs within a few minutes after the burn. There is also an early filtration process across a blood-lymph barrier with increased permeability which becomes maximal within 3 hours and persists for at least 3 weeks.

Plasma lipids and lipoproteins in burns, by Dr. S.O. Liljedahl (King Gustav VI Research Inst. Stockholm 60, Sweden). The levels of free fatty acids (FFA), cholesterol, phospholipids, and triglycerides were correlated with the extent of trauma in a series of 38 patients. It was demonstrated that the FFA concentration was elevated initially and the extent of elevation was dependent on the severity of the burn. The cholesterol and phospholipids decreased, in proportion to the trauma, during the first 7-10 days and did not return to levels noted on the day of trauma for 6-12 months. During the first six

weeks after injury, there was a correlation between the cholesterol concentration and the albumin levels. The plasma concentration of high and low density lipoproteins was also reduced during the first 7-10 days after the burn. The changes were attributed to increased activity of the sympathetic nervous system and altered liver metabolism.

The metabolism of fibrinogen by patients with burns, by Dr. J.W.L. Davies (MRC Burns Unit, Birmingham Accident Hospital, Birmingham). Radioactive iodine-labeled fibrinogen is used to determine the metabolism of fibrinogen among patients with burns of varying sizes. It appears that the plasma fibrinogen levels tend to change in parallel with total albumin.

Alterations in the serum protein chromatograph during the course of deep burns in humans studied by paper electrophoresis, by Dr. R. Tubiana (47 Quai Grands-Augustins, Paris VI). A total of 100 patients were studied. Electrophoretic patterns were determined at regular intervals until complete recovery. All patients required grafting and were divided into four groups according to the extent of their burn. The findings listed below were more pronounced among patients with more severe burns:

"1. During the first ten days after burning, the albumin and globulin levels fell to the same degree. The drop in total globulins reflects the drop in gamma- and beta-globulins; on the other hand, the alpha 1 and alpha 2 globulin levels begin to rise at this time.

"2. On the fifth or sixth day (average), an abrupt change in the albumin-globulin ratio occurs. While the total globulin level rises because of the increase in alpha 1 and alpha 2, the total albumin level continues to fall.

"3. The restoration of the A/G ratio takes place very slowly and only after graft resurfacing of the burn wounds has been completed. It is long after complete healing that the total protein value approaches normal."

Serum enzyme levels in burned patients, by Dr. G.N.G. Barton (Pathology Dept., Salisbury General Hospital, Salisbury, England). A comprehensive battery of serum enzyme levels, including pseudocholinesterase, glutamic oxalacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase, lactic dehydrogenase, and aldolase, were performed on 23 unselected, hospitalized burn patients. Partial studies were determined on five additional patients. Estimations were made daily for four or five days, then on alternate days for an additional ten to eleven days. There was a change in serum enzyme levels in nearly

all cases, suggesting the presence of a toxic effect on the liver after burning. The pseudocholinesterase and serum glutamic pyruvic transaminase (SGPT) levels were most often altered. The serum pseudocholinesterase levels began to decrease before the fourth day, and the SGPT levels began increasing on the sixth to tenth day following injury.

Some observations on duodenal and gastric ulceration after burning, by Dr. S. Sevitt (Birmingham Accident Hospital, Birmingham). A total of 291 burned patients were necropsied between 1948 and 1964 and the relationship of gastrointestinal lesions to the injury was evaluated. It was found that 26 (8.9%) had acute duodenal ulcers and 42 (14.4%) had gastric erosions. Analysis of the data indicated that "duodenal ulcers, unlike gastric erosions, never appeared during the first day after burning, did not form after burns involving less than ten percent of t's body area in children or adults, were relatively common in adults with burns of ten percent body area during the first week after burning, but not thereafter; and were uncommon in children even with extensive burns during the first week but appeared relatively frequently from the third week onward." Sevitt is conducting further analysis of other parameters and suggests a significant relationship between blood groups O or B and duodenal ulceration.

Metabolic responses of the burned organism, by Dr. R. Dolecek, Consultant Endocrinologist (Burn Unit of Ostrava, K.U.N.Z., Syllabova 19, Ostrava, Czechoslovakia). Experimental studies on burned rats have revealed a significant increase in alpha-ketoglutarate values, blood glucose and unesterified fatty acids. There is also a decrease of glycogen in muscle, liver and heart tissue, and a decrease in muscle and heart potassium levels. Totally adrenalectomized rats revealed no evidence of a metabolic response after burning.

In severely burned human patients, increased values of pyruvate, lactate, citrate, alpha-ketoglutarate, blood sugar and unesterified fatty acids were noted. In the later stages, the same determinations were found to be abnormally low. Dolecek claims that the source of energy in severely burned patients is mainly fats.

The effect of human growth hormone on the metabolic response to burns, by Dr. H. Sorroff (Tufts New England Medical School, 171 Harrison Ave., Boston, Mass.). The experimental design allows data to be subjected to the analysis of variance and permits independent comparisons. The author reported on only two cases studied and claims that "... nitrogen balance was significantly more positive during the growth hormone

periods as compared with the control periods in the early catabolic phase." The study was repeated during the late catabolic phase (begin post-burn day 30) with similar results. During the anabolic phase (begin post-burn day 80), the growth hormone was not associated with storage of nitrogen.

There were no consistent effects of growth hormones on sodium or chloride balances and the positive potassium balance was not statistically significant.

Nitrogen and caloric requirements in burned children, by Miss A.B. Sutherland (Dept. of Plastic Surgery, Royal Hospital for Sick Children, Edinburgh). In children with burns up to 50% full thickness involvement, the intake of nitrogen and calories need be no greater than for the same child in good health in full activity.

Energy metabolism after injury, by Dr. H.B. Stoner (Medical Research Laboratories, Woodmansterne Rd., Carshalton, England). This paper compared the derangement of energy metabolism produced by an injury such as limb ischaemia and by burns.

Changes in lactate pyruvate and excess lactate in burned patients with hypoxaemia, by Dr. H.P. Harrison (Tufts New England Medical Center, 171 Harrison Ave., Boston, Mass.). Nine patients were studied to determine whether a significant tissue hypoxaemia accompanied lowered arterial oxygen levels. The patients and a group of normally oxygenating burned patients as controls were evaluated by measuring arterial pO_2, pCO_2, pH, lactate, pyruvate and blood electrolytes. Excess lactate was calculated from differences in lactate and pyruvate concentration during air and oxygen breathing. One patient with pO_2 54.58 mm Hg evidenced small values of excess lactate but at arterial pO_2 values from 60-84 mm Hg, excess lactate was absent or minimal. The arterial lactate concentrations were much less than those expected in shock and inadequate cardio-vascular function, but were compatible with the hyperventilation and alkalosis present.

Evaporative water loss in third degree burns, by Dr. C.F. Roe (Columbia Presbyterian Hospital, New York, N.Y.). Severe burns are perhaps the only trauma that increase energy expenditure to an extent that the metabolic rate can be increased up to 100% over resting levels. It has been shown that the high oxygen consumption of burned rats is related to the evaporative water loss through the burned skin.

A sensitive bed scale has permitted the author to measure the rate of evaporative water loss from patients with extensive third degree burns. Losses vary between three and ten times the normal rate with measured losses up to 8 liters a day. With this information it was possible to construct a total fluid balance chart. Thus it was feasible to replace fluid loss and to evaluate changes in serum sodium, blood urea nitrogen, urine volume and hematocrit. It was found that the serum sodium concentration was a much more reliable index of hydration than the hematocrit, and the urine volume was quite unreliable as an index in these patients.

The energy expenditure resulting from this high water loss was studied also. Approximately 2800 Kilocalories per day was the body heat loss from evaporation of five liters of water. Standard indirect calorimetry results indicated a good correlation between rates of evaporative water loss and excessive metabolic rate. Covering burned areas with an impermeable plastic sheet reduced both the rate of evaporative water loss and the rate of oxygen consumption.

The pace of the Conference slackened only slightly on the second day, when 17 papers were presented during the three sessions. Several presentations were on problems in developing nations, and these abstracts are quoted below to emphasize the needs of these countries.

Some observations on burns in a tropical climate and the type of technical cooperation needed by developing countries overseas, by Mr. M.N. Tempest (University College Hospital, Ibadan, Nigeria).

"The observations and comments are based on 3½ years work in Nigeria, and are personal views only -- though the comments probably would find wide acceptance.

"Nigeria is one of the largest republics on the West African coast, already with a population of over 56 million. In the industrial field its rate of development is faster than many of its neighbours; in health its progress is pathetically inadequate.

"No figures are available to give any idea of the incidence of or the mortality from burns. There are no coroner's courts and death registration is available only in two or three of the large towns. Hospital records are either inadequate or non-existent.

"Nevertheless, burns are common. The mortality is a great deal higher than in other countries, and the pattern of burning different.

Causation. These are domestic rather than industrial. The common causes of burning are from accidents with cooking fires and cooking fats and oils, and chemical burns from acids and alkalis, especially caustic soda which is used in making soap in the home. Burns occurring during sleep are also common. Burns in epileptics and electrical burns are rare and the young baby is seldom burned, being carried on the mother's back. Some burns and scalds in young children are the result of deliberate infliction in the treatment of convulsions. Burns of the vagina are seen following the insertion of caustic pastes for treatment of infertility and attempts to prolong menstruation. Burns are also seen in sufferers from leprosy.

"Complications include tetanus, crippling deformities and malignant change in burn scars.

Treatment. Blood and dextran are available but plasma is very scarce and electrolyte solutions are needed more often. Formulae are meaningless, because of widespread anemia. The incidence of the SS and SC genotype is an added danger in blood transfusions.

"2. Sedation is more often necessary because of difficulty of communication with young children.

"3. Malnutrition, diarrhoea and vomiting are common and are a severe hindrance to recovery.

"4. Exposure and dressings can be used as in any other country, but dressings are very expensive and are liable to be mis-used. Exposure is often a synonym for doing nothing at all.

"Workers in these surroundings must remember that any and every scheme put forward either as a research, clinical, or therapeutic project is to be related to:-

1. A severe shortage of doctors, nurses, drugs and dressings.
2. Scattered and inadequate hospitals.
3. A general fatalistic attitude to life which can become a blank wall of indifference to suffering.
4. Standards of responsibility to one's patients and a code of ethical practice which is foreign to the trained specialist doctor or nurse from Western Europe.

"The treatment of burns needs a team -- surgeon, anaesthetist and some nurses. This team should be sent to the underdeveloped country to train a team -- not in fancy biochemistry, but in basic principles, clinical judgment and the ways and means of improvisation. "Hospital" accommodation may have to be in tents or huts.

"Once the country concerned has its own first team, this can do some of the training and allow the foreign team to go elsewhere in that country and repeat the process. Once liaison has been established between the underdeveloped country and the training country, selected doctors can then be carefully chosen and sent to that country for detailed training in a large unit."

The problem of burns in one of the developing countries, by Dr. F. Zdravic (Floriana D/IV, Parc de Pons, El Bier, Algeria A1).

"Size of the problem. Algeria is a developing country of about 12 million inhabitants in a territory of 2 million square kilometers. This alone and the lack of proper medical care in whole regions accounts for the fact that burns are mostly treated at home where no general treatment is given and the only local treatment often consists of exposure to sunshine.

"Incidence. It is believed that about 30 children and adults die each week as a result of burns, mostly because of the lack of initial care, while those surviving often have monstrous deformities. No exact statistical data exist at the present time. Data available in certain regions permit the conclusion that there are about 3,000 burn cases admitted to the 144 hospitals of the country and that probably double or triple that number are left at home without proper treatment.

"Causes. Among the causes, open campfires in the nomad population areas of the Sahara are responsible for most of the burns in children. The greatest source of burns seems to be from widespread use of a small, unstable petrol stove used especially by the poorer sections of the population. A great number of burns of the hands is seen in the totally blind, numbering about 50,000, trachoma being still the principal cause of blindness.

"Late deformities. Late deformities are closely related to the standard of care and the recent seven years' war, when napalm bombs were used, is one of the major factors contributing to the number of deformities. Some typical

groups of late deformities have been studied closely.

"The unnecessarily long and predominantly conservative hospital treatment and the maintenance of those incapacitated as a result of burns cause the government great expense.

"Prevention, teaching and organisation of treatment. A detailed analysis of the situation is under way. A large program of prevention, teaching of up-to-date treatment of burns in three large hospital centers, and the creation of at least one specialized burn unit is proposed by the author."

Burns in the U.A.R., by Col. A.W. Reda Mabrouk (25 Yacoub St., Mallia, Cairo, U.A.R.).

"The main causes are domestic, industrial and military. Burning is also a fairly common method of attempting suicide.

"Management of burned patients: Previously, burned patients were managed in general surgical wards under the care of general surgeons, and burn dressings were done mainly by members of the nursing staff. Grafting was delayed and the development of contractures and deformities was common. Patients with these complications were transferred to the plastic surgeon for correction.

"In October 1961 a plastic surgery unit of 80 beds was developed in Helmiah General Hospital. Burned patients are accepted from the start in this unit. A well equipped laboratory and a physiotherapy department are attached to this unit.

"In January 1963 a burn section of six beds was developed in Heliopolis Hospital. The section accepted paying patients who are mainly workers whose expenses are paid by the Social Insurance Organisation or by their own companies.

"In both centres patients stay in hospital until their burn wounds heal completely and they return for correction of any deformity which may result.

"The routine management of burned patients is the same in both centers. Human plasma is the main fluid used to correct oligaemia and blood is given when indicated. Dressings are done by the surgeon in the theare under gas and oxygen sedation of a cocktail of Pethidine, Taractan and Antistine. Excision of the sloughs is done after 14-21 days, followed in 3-5 days by grafting. The blood picture is estimated weekly and any error is corrected accordingly.

"The stay in hospital ranges between 2-3 months for cases which need grafting.

"Another plastic surgery unit is being developed in Naadi and two other units will be developed in industrial areas.

"Information gained in the two centers will be presented with special reference to the number of burns treated and their extent, the cost of treatment and the problem of sedation for dressings."

A survey of burn accidents in Bombay, by Dr. N.H. Antia (Ben Nevis, B. Desia Rd., Bombay, India).

"In May 1963, a project was undertaken to study the causation and prevention of burns at the J.J. Group of Hospitals, and the study was concentrated in the city of Bombay after undertaking a rural traceability survey at Sirur -- a village in Maharashtra.

"A purely representative sample of all burns cases in Bombay is not feasible as these cases are distributed in various hospitals and private nursing homes, which are inaccessible to the social worker. Hence four such public hospitals of the city were selected to give a geographical, socio-economic and communal representation of the population. The four hospitals represented different residential communities -- a crowded middle class residential area of the city, an industrial area, a suburban residential area, and one serving the Employees' State Insurance Scheme.

"Twice weekly, the social worker interviews the in-patients and his/her relative in the hospital. Visits are also made in selected cases to the homes, factories and mills to study the living and working conditions of the patients.

"Contacts were also made with manufacturers of stoves, the fire brigade, civil engineers and architects.

"The first eight months were spent in drafting, pretesting the questionnaire and arranging it in a suitable form for use in an IBM computer. The study will cover 800-1000 cases. Patients with burns of over 25% body surface involvement will be followed up for a period of six months after the accident to get information on the 'outcome of injury.'

"The following conclusions are apparent from the preliminary study:

(1) A large number of burns cases are pure accidents.

(2) Domestic burns are largely due to pressure stoves and old fashioned kerosene lamps. Industrial accidents are due to acids, tar, steam and sticky components like starch and cold sticker.

(3) In domestic burns, small tenements, large families, lack of raised platforms and inadequate storage are the obvious causative factors. Absence of a safe stove and ignorance on the part of a large sector of the public regarding handling of a pressure stove is the cause of many burns. In industrial burns, absence of good safety measures, coupled with careleness, is the cause of many accidents.

(4) The saree appears to be a dangerous garment in overcongested city dwellings.

(5) Place of accident varies from one to two room brick tenements to tin sheds and mud huts which are themselves combustible.

"In addition to the physical factors responsible for the accident, there are the less obvious and often more important psychological factors. These include alcoholism, emotional stress, time stress, unfavourable living conditions and group relations, and fatigue -- both mental and physical.

"Finally, fatalism whether good or bad is the hallmark of many cases. The accident is accepted as something predestined."

Recent experiences in the surgical treatment of burns in Japan, by Dr. Seiichi Ohmori (Chief, Plastic Surgical Service, Tokyo Univ., and Metropolitan Police Hospital, Tokyo). Ohmori made a plea for increased utilization of surgical treatment of burns to prevent keloid formation. He presented data relative to keloid formation among Japanese burn patients and concluded that the scarring of the skin donor area varies with the thickness of the split thickness graft.

Treatment of the victims from the great catastrophe of the Gran Circus of Niterói (Brazil), by Dr. I. Pitanguy (Rua Dona Mariana 65, Botafogo, Rio de Janeiro, Brazil). This paper described some problems faced by the medical profession in the mass casualty situation created by the circus tent fire in December 1961. The shortage of supplies and equipment and partial

closure of the Municipal Hospital because of a salary dispute contributed to the difficulties. There were approximately 400 deaths, 70% of them children. Many deaths were due to pulmonary complications. Pitanguy commented on the difficulties encountered in maintaining the hydration of victims with tracheotomies and on the magnitude of the therapeutic challenge, even at the later phase of treatment of sequelae.

Problems met with in epidemiological studies of burns on an international scale, by Dr. Z. Kulcar (Inst. of Public Health, Rockefellerova 7, Zagreb, Yugoslavia). The problems of classification of burns as to source, area, and extent in a single country were outlined. The difficulties in performing epidemiological studies on an international basis cannot really be solved until standardized procedures for collecting and disseminating data are developed and accepted. Until such time, it is hoped that all countries will adopt the WHO classification.

The social and economic consequences of deep burns, by Dr. Bengt Korlof (Plastikkirurgiska Kliniken, Akademiska Sjukhuset, Uppsala, Sweden). All patients treated for deep burns at the Burns Unit, Uppsala, during a ten-year period received questionnaires requesting certain socio-economic data. The response was 78% and the data indicated: few matrimonial problems were attributed to the injury; 20% thought the choice of employment was affected; 21% thought their work progress was affected; few people changed locations because of the injury.

Organization and statistical study of the Burns Service at the Mexican Inst. of Social Security, by Dr. L. Correa (Inglesia No. 221, Mexico 20, D.F.). This illustrated presentation depicted the beautiful, modern physical plant and available equipment for treatment of burn injuries. The sterilized air conditioning system appears to aid in minimizing cross infection. The team approach, using plastic surgeons, internists, physical therapists, and specially trained nurses, is utilized in caring for the patients. Treatment begins with good resuscitation with fluids, plasma, blood, etc., as indicated. A high protein diet is administered as soon as possible. The exposure method is the treatment of choice. The author's clinical impression was that their results were excellent.

Analysis of mortality and length of hospital care for 603 burned patients referred for primary treatment, by Dr. G. Birke (Gustav 5 Forskningsinstitut, Karolinska Sjukhuset, Uppsala, Sweden). The series of 603 patients was derived from two consecutive time frames, 426 patients during the six-year period 1954-59 (Group A) and 177 patients during the four years, 1960-63 (Group B). The patients in both Groups were given plasma and blood in a proportion of 4:1, but Group B received additional albumin, gamma-globulin and larger volumes of electrolytes and fluids on post-burn days 3-10. Group B patients were also treated in special isolation facilities if they suffered from "medium-sized or larger" burns. It was stated that the number of these more serious burns in Group B was about equal to those of Group A.

The Probit technique of analysis was used to compare the author's data with that of the series reported by Bull and Fisher (1954). There was a significant reduction of mortality among Group A only for patients over 65 years. In Group B, the mortality was significantly reduced for all patients over 15 years. The significant reduction of mortality among patients 15-64 years in Group B over those ages in Group A are attributed to a decline in mortality from sepsis.

Probit analysis of burns mortality, by Dr. J.P. Bull (MRC Burns Unit, Birmingham Accident Hospital, Birmingham). Since burns can be assigned a numerical measure of severity, they can be analyzed similarly to animal toxicity data. The Probit analysis based on a sigmoid mortality curve can be used. Bull outlined the method of calculation and presented data revealing the comparability of mortality results from several treatment centers.

The storage of human skin, by Mr. A.C. Buchan (Dept. of Plastic Surgery, Bangour General Hospital, Broxbourne, England). Growth of skin in roller tubes has permitted investigations to determine the efficacy of varying methods of storing skin to be used as homografts on severely burned patients. Buchan has arrived at the following conclusions:

"1. Skin stored above freezing point will retain its viability for 3-4 weeks. The method of storage is probably not important, provided dehydration is prevented, and the more complex method of storage in 10 percent serum does not have any advantage. Short-term storage above freezing point is sufficient for many purposes, but it is not adequate for a homograft skin bank.

"2. The *in vitro* growth of skin treated with concentrations of glycerol under 50% is almost identical with the growth of untreated skin.

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"3. Skin treated with 15 and 25 percent glycerol prior to rapid freezing and thawing gives a very similar pattern of growth as glycerol-treated unfrozen skin.

"4. Preliminary experiments suggest that the rate of freezing is not important, but rapid thawing is required if viability is to be retained.

"5. Living homografts provide temporary skin cover for 4-6 weeks, and here experiments suggest that low temperature storage of glycerol-treated skin would be a practical method for a skin bank.

"6. Freeze-dried homografts are dead, but they provide temporary skin cover for two to three weeks. They adhere to the granulations less readily than living skin, and until they disintegrate the naked eye appearances are similar to an autograft. The simple storage and transport of this type of graft is a major advantage."

Treatment of the burned surface, by Mr. D. Matthews (152 Harley St., London, W. 1). The author has used cadaver skin as homograft material in severely burned patients. No attempt was made to match age, sex, blood group, etc., of the recipient with that of the donor. The only restriction imposed was a limit of 16-18 hours elapsed time between death of the donor and applying the graft to the recipient. The results were considered very good by the author, and the photographic illustration was impressive.

Levitation, a possible means of treating burns, by John T. Scales (Inst. of Orthopaedics, Univ. of London, Royal National Orthopaedic Hospital, London). This was an illustrated presentation of the levitation bed. The great advantage claimed was drying of the surface to aid in preventing fluid loss. The apparatus is noisy because of the air pressure required to "suspend" the patient.

Hypnosis in the treatment of burns; clinical reports and animal experiments, by Dr. B. Sorensen (Burns Unit, Municipal Hospital, Copenhagen, Denmark). This presentation consisted of a film demonstrating debridement and dressing of burned patients, using hypnosis as "anesthesia."

The electrical burn, by Dr. O.M. Ugland (Plastikkirurgiska Kliniken, Akademiska Sjukhuset, Uppsala, Sweden). The report described technology used to conduct neurophysiological investigations into the damage to peripheral nerves

by electrical burns. The investigations are rather preliminary, and much work remains to be done.

Evaluation of tissue destruction using the fluorescence of tetracycline antibiotics, by Dr. M. Dobrkovsky (Burns Unit, Legerova 63, Prague, Czechoslovakia). Experimental animal studies have indicated that fluorescence under UV light subsequent to administration of chlortetracycline will aid in determining burn damage. The fluorescence varies with the depth of the burn. Dobrkovsky states that the same phenomenon is applicable to human patients and attributes the degree of fluorescence to variable incorporation of the antibiotic into the tissue cells.

After 37 papers in two days, all delegates were ready for the single session incorporating only five papers on the third day of the Conference. This session was organized as a symposium on infection and the chairman stimulated considerable discussion on the routine use of antibiotics, local treatment and the problem of septicemia.

The importance of infection and host resistance on mortality after thermal trauma in mice, by Dr. Kehl Markley (National Institutes of Health, Bethesda, Maryland, USA). The shock mortality among scalded, germ-free mice was significantly less than among conventional mice, and the later mortality experience after moderate burns was similar. The addition of E. coli to the environment of specific pathogen-free mice was associated with a significant increase in shock mortality.

Burned conventional mice were subjected to E. coli endotoxin and found to be up to 1000 times more sensitive than non-burned mice during the first 12 hours post-burn. Furthermore, mildly burned conventional mice were much less resistant to an intraperitoneal injection of Ps. aeruginosa during the first 3-4 days after the burn. If these animals were given E. coli endotoxin or some non-specific bacterial vaccines prior to burning, there was a significant increase in resistance to death from shock. Prior administration of a Ps. aeruginosa vaccine also protected burned animals subsequently subjected to a Pseudomonas challenge.

Preliminary evaluation of Pseudomonas vaccine and hyperimmune plasma in the treatment of seriously burned patients, by Dr. Irvine Feller (Univ. of Michigan, Ann Arbor, Mich.). During the past two years, 32 patients with burns involving 40% of the body surface or full-thickness burns involving 20% of the surface have been treated with Pseudomonas vaccine or a combination of the vaccine and hyperimmune plasma. The 39 control patients had similar burns and the management of the 71 patients was considered no different except for the vaccine and plasma. It was reported

that the treated patients experienced an over-all decrease in mortality, a marked reduction of the incidence of Pseudomonas septicemia, a decrease in length of hospitalization, and an increased survival time among those who died.

Antiserum for prophylaxis against infection with Pseudomonas aeruginosa, by Dr. R.J. Jones (MRC Burn Unit, Birmingham Accident Hospital, Birmingham). Groups of mice were subjected to full-thickness burns of approximately 6% body surface. The mortality (9%) was not increased by direct contamination of the burned surface with S. aureus, E. coli, K. aerogenes, but was increased to 71% when Ps. aeruginosa was applied to the wound and to 54% when P. mirabilis was used. The last two organisms were cultured from cardiac blood of the mice that died. It was reported that intraperitoneal injection of rabbit Ps. aeruginosa antiserum prevented death of burned mice infected with this organism.

A study of Pseudomonas pyocania cross-infection in a burns unit, by Dr. J. Kohn (Pathology Dept., Queen Mary's Hospital, Roehampton, England). This interesting paper outlined the methodology used in performing the study and presented considerable data relating several parameters to Pseudomonas infection. It was not surprising that the environmental sampling revealed positive cultures approximately 50% of the time when "moist" sites (sinks, bowls, brushes, thermometers, etc.) were sampled, and only 13% when "dry" sites (air, dust, floors, walls, shoes, etc.) were studied. There was also an increasing prevalence of infection with burns involving greater surface area from 7% with a burn involving less than 10% body surface to 100% infection among patients sustaining burns to 40% or more body-surface area. Infection also increased with length of stay, and older patients (over 50 years) were found to be infected more frequently than younger ones with similar areas of injury.

In this Unit, it was found that two "resident" strains were most frequently involved, but occasionally an "interloper" would be responsible for a single or for very few infections.

Topical use of antibodies was stated to be very valuable in control. Isolation techniques must be strict to be of value. Exposure treatment seems to be of value by rendering the micro-environment less suitable for growth of Pseudomonas. Autoclaving equipment and solutions is, of course, of value, but one must remember to dismantle and sterilize component parts of things such as suction apparatus,

resuscitation equipment, etc. Scrupulous attention to hand scrubbing and drying with sterile brushes and towels, ensuring that the soap used does not harbor Ps. pyocania, and the use of disposable supplies will also aid in prevention of cross-infection. Disinfectants were found rather disappointing, but iodophors were of some value and peracetic acid appears promising. Kohn feels that studies directed toward increasing host resistance, vaccines or antisera, are of utmost importance and may ultimately provide the solution to the cross-infection problem.

Control of infection from Staphylococci aureus carriers, by Dr. R. Blowers (Public Health Laboratories, Ayresome, Green Lane, Middlesbrough, England). Blowers performed air sampling in a special chamber and in an operating room and reported several findings: (1) a shower bath immediately prior to going into the operating room increased dispersal; (2) dispersal was not reduced by changing into routine "scrub suits"; (3) male staff appeared to be greater offenders at dispersing th female staff, in spite of similar carriage rates; (4) dispersal could be reduced by wearing "scrub suits" of closely woven fabric or paper of the type used for disposable surgical towels; and (5) dispersal by patients was also increased by pre-operative bathing and could be reduced if paper rather than cloth clothing was worn into the operating room.

The open discussion following the formal papers was lively and interesting but inconclusive. The answer as to the value of various types of local treatment and routine administration of antibiotics seems to remain obscure in spite of many years of clinical observation.

The fourth day was a "return to the salt mines" with 20 formal presentations during four consecutive sessions.

Polyurethane foam in the treatment of burns, by Mr. A.J. Evans (80 Harley St., London, W. 1). The illustrated presentation by Evans pointed out the advantages of caring for a patient lying on sterilized polyurethane foam, which allows evaporation to occur from the surface on which the patient lies. This material is inert, porous, and can be autoclaved or irradiated to ensure sterility.

The use of foam has been successfully extended to serve as a pressure dressing over donor or graft sites.

Polyurethane foam as a first aid dressing for burns, by Col. J.M. Matheson (Royal Army Medical College, Millbank, London, S.W. 1). Polyurethane foam dressings are recommended as first aid treatment. The advantages are ease of application, comfort, it allows drying of the surface, and, of course, can be sterilized and is not expensive. The first aid dressing should be removed in less than 48 hours.

An application of artificial skin for full thickness burns, by Dr. Shuichi Hayaski (Jutendo Univ. Medical School, Hongo, Tokyo, Japan). The author presented information on the experimental and clinical use of polyvinyl alcohol sponge (PVA) applied in lieu of skin. The autoclaved PVA is 7 mm thick and is claimed to reduce bacterial invasion because of residual formalin. Hayaski claims that areas covered with PVA produce excellent granulation tissue which readily accept definitive skin grafting at the appropriate time.

Silicone immersion burn therapy, by Dr. Melvin Spira (Baylor Univ., Houston, Texas). Synthetic linear polymers of silicone dioxide have been shown to be physiologically inert. A tank has been designed which allows the fluid to be recirculated, filtered, deodorized and temperature-controlled. The patient is placed in the tank with the aid of a hydraulic lift system and is immersed from the neck down after his clinical condition is stabilized. The author claims that bloodless debridement of full thickness burns is accelerated and that second-degree burns are allowed to epithelialize. There are no deleterious effects on normal skin, there is less pain, and early joint motion is encouraged. It is also claimed that such treatment is associated with increased renal function, improvement in nutritional status, and a marked reduction in blood transfusions necessary to maintain normal circulating blood volume.

A substitute paper on Silver nitrate treatment of burns, by Dr. L. Brentano (Dept. of Surgery, Washington Univ., St. Louis, Missouri) provided data on a series of burn patients treated locally with silver nitrate. The major disadvantage admitted was the staining, but silver nitrate dressings were said to reduce infection and mortality.

Bacteriological and histological response of excised rat wounds to synthetic skin grafts, by Dr. H.N. Harrison (Tufts New England Medical Center, 171 Harrison Ave., Boston, Mass.). Rat burn wounds were excised and covered with synthetic materials, including foam and film collagen, silastic, polymethacrylate and a microporous polyethylene film. Large

numbers of bacteria, up to 10^8 organisms per gram tissue, became established on all synthetic covered wounds within three days. The flora were predominantly streptococci and staphylococci during the first week, with Proteus and Pseudomonas also detected in the second week. This experimental model provides a new tool for studying methods of controlling burn wound infection.

The use of non-stored, sterilized body-homografts in the treatment of severely burned patients, by Dr. Bent Sorenson (Burns Unit, Municipal Hospital, Copenhagen, Denmark). Satisfactory homografts can be taken from corpses. It is best to take skin from those who were young and healthy immediately prior to death as soon as possible after death. It is suggested, however, that if skin is taken from the elderly, it is better to wait "a long time" after death. The skin taken from the corpse is treated in 0.9% saline solution containing neomycin and penicillin for 24 hours, rinsed in normal saline, and stored in the refrigerator for possible use during the next few days.

Another brief substitute paper, Early excision of burn wounds, by Dr. Bruce McMillan (Cincinnati General Hospital, Cincinatti, Ohio) was a summary of results. This method of treatment was considered especially useful after electrical or chemical full-thickness burns involving up to 15% of the body surface area.

Hypertonicity disorders in the burned patient -- recognition, pathogenesis, and treatment, by Prof. Francis D. Moore (Harvard Medical School, Peter Bent Brigham Hospital, Boston, Mass.). The hypertonicity, which is sometimes observed to be progressive and may become a terminal mechanism in burns, is "due to a disorder in balance between body water and low molecular weight solute present in the body." There may be hypertonic patients with oliguria or with polyuria. The oliguric patients may have acute renal failure or may have normal kidney function but become desiccated and dehydrated due to insufficient fluid administration. The polyuric syndromes are all those of solute diuresis such as diabetes mellitus, "burn pseudodiabetes," treatment with excessive amounts of mannitol, and can be caused by treatment with the dextrans.

Intermittent total body saline irrigation in burn therapy, by Dr. R.F. Hagerty (Univ. of South Carolina, Charleston, S.C.). Patients who had over 20% third-degree burns were treated by immersion in tanks containing either water or 0.9% saline. All patients were subjected to the irrigation for one hour on alternate days. Blood urea nitrogen (BUN) of patients treated in the saline tanks consistently decreased, and serum osmolality increased. There were variable alterations in serum sodium, potassium, chloride,

and proteins. The patients treated in the water tanks demonstrated no change in BUN, but the serum osmolality, sodium chloride, total proteins and albumin consistently decreased. It was also reported that the eschar separated earlier, granulations appeared healthier and epithelialization developed more rapidly among the saline-treated patients.

Local treatment as studied in 1000 experimental burns in humans, by Dr. John M. Howard (Hahneman Hospital, Philadelphia, Penna.). A controlled study among 250 volunteers subjected to second-degree burns on each of the four extremities has not provided a definitive answer to the best method for local treatment of burns. The burns, produced by high intensity quartz lamps regulated by a timer to standardize burn intensity, have been treated by 20 different regimens of local treatment.

Attempt to isolate the antigen from thermally injured skin, by Dr. L. Pavkova (Laboratory of Plastic Surgery, Legerova 61, Prague 2, Czechoslovakia). The author reported on attempts to isolate the antigen of burned skin. Heating skin *in vitro* to 50°C produces antigenic changes which are maximal at 70-80°C. Denaturation of skin protein occurs on heating to 100°C and the antigenicity disappears. Skin heated, *in vitro*, to 70°C for two minutes was homogenized and centrifuged. The lipidic factors were isolated from the supernatant by fat solvents under different conditions but separation of a serologically active factor was not accomplished. After denaturation of proteins, removal of the sulfosalicylic acid by dialysis and then centrifugation, the supernatant retained serologic positivity. Pavkova stated that "... the combination of peptidic and lipidic factors is indispensable for serologic positivity."

Biologic effects of burned skin on mice, by Dr. J.C. Lawrence (MRC Burns Unit, Birmingham Accident Hospital, Birmingham). Extracts of heated skins cause a sequence of reactions similar to those caused by burning. Injection of normal skin extracts into the mice is without effect. Investigations are under way to determine the nature of the toxic material.

Immunological reactions after tissue injury, by Dr. D.M. Weir (Immunology Dept., Bacteriology, Edinburgh Univ., Edinburgh). An experimental model in which the tissue damage is that of liver injury in rats produced by carbon tetrachloride and other agents has been used. An auto-reactive antibody of the 19S macroglobulin type is produced. The experimental results show that "... there is an immunological response to a subcellular component released following cell damage, and the possibility that this may be an example of a general phenomenon

following tissue injury of man types is suggested by the presence of a similar antigenic component in the cells of other tissues in addition to liver. The part played by antibodies of this type in the events following tissue damage remains obscure; one possibility is that the antibodies may be concerned with the removal of tissue breakdown products -- the antibodies acting as carrier globulins. Experiments so far carried out in the carbon tetrachloride system indicate that no difference exists between the ability of rats to eliminate liver antigens in groups of animals with antibody and groups of animals in whom the antibody response has been suppressed by X-irradiation. A second possibility is that the combination of antibody with a cellular component exposed by cell injury may result in the release of chemotactic agents which induce polymorphs to infiltrate the damaged area, which then proceed to clear away the tissue debris, and experiments are under way to test this possibility."

Complement active serum proteins in clinical burns, by Dr. K.E. Fjellström (Univ. of Clinical Chemistry, Uppsala, Sweden). Serum samples from 13 patients (ten burns and three undergoing surgery to serve as controls) were studied to determine titres of complement components and protein changes. The results were:

"1. In cases of severe burns the titres of the complement components even during the first day after the trauma were as low as ten percent of those in normal cases and remained so until death.

"2. In the patients who survived, the complement titres decreased moderately or not at all. From the end of the first week after the trauma the titres regularly reached values exceeding the normal level one to two times.

"3. This increase in complement titres remained for several weeks. In one patient who was observed for a long period, the titres were not normalized until two months after the burn.

"4. Analysis of the electropherograms showed the known albumin decrease, but more characteristically a very pronounced decrease of some globulins in the alpha-beta region.

"The changes of complement in the burn syndrome are discussed as being due to: (a) immune reaction; (b) an altered coagulation mechanism; and (c) complement proteins whose function is to repair damaged tissue."

Alterations in immunological responsiveness associated with severe thermal injury, by Dr. J.M. Converse (Plastic Surgery Service, Bellevue Hospital, New York, N.Y.). The observation that skin homografts persist for prolonged periods in burned recipients suggested that the immunological response might be that of a delayed or cellular type of hypersensitivity. This hypothesis was tested by making guinea pigs hypersensitive to tuberculin prior to producing full-thickness burns to various body surface areas. The animals were re-tested with tuberculin at weekly intervals subsequent to the injury, and it was found that the application of severe thermal injury to the tuberculin-sensitized animals induced a marked diminution in their ability to exhibit delayed skin hypersensitivity reactions to the antigen. The author concluded: "This observation parallels the finding that skin homografts enjoy a longer period of survival in severely burned recipients. It lends further support to the possibility that the parameter of immunologic reactivity impaired by severe thermal injury may be related to hypersensitivity mechanisms of the delayed or bacterial type."

Toxicity and bacteria content in homogenates of normal and burned skin, by Prof. L. Koslowski (Oberärzt der Chirurgischen, Universitätsklinik, Freiburg i. Br., Hugstetterstr. 55, Federal Republic of Germany). A study was made to determine if burned skin was toxic *per se* or if bacterial infection is responsible for the toxicity. It was reported that homogenates of burned rat skin were toxic when injected peritoneally into mice. Normal rat skin homogenate with known quantities of various bacteria were also injected into mice. The mortality under these conditions was less than with burned skin contaminated by less or equal quantities of similar organisms.

Stimulation of the burn syndrome by toxic thromboplastic extracts of skin and muscle, by Dr. Charles L. Fox (Bellevue Hospital, New York, N.Y.). Extracts of "toxic" substances from burned skin injected into normal mice were associated with hypercoagulability of the blood. These potent "toxic" fractions make a minor burn behave like a severe one in experimental studies. It was concluded that, "Skin and muscle cells contain thromboplastic, toxic constituents which may be released by thermal trauma, enter the circulation, alter the rheology of the blood and contribute to the circulatory failure, thrombo-embolic and other phenomena of burn shock."

Our experience with the convalescent serum therapy in the chronic stage of burns illness, by Dr. Jarmila Dolezalova (Laboratory of Plastic Surgery, Legerova 61, Prague, Czechoslovakia). The author briefly reported clinical observations and was of the opinion that convalescent serum reduced the incidence of emotional problems associated with burns, reduced infection, especially with staphylococci, and reduced total morbidity.

Human "burn toxin" and its neutralization, by Dr. Sol Roy Rosenthal (Dept. of Preventive Medicine, Univ. of Illinois College of Medicine, Chicago, Ill.). A heated skin homogenate produced 83% mortality after intravenous injection into normal mice as compared with a 22% death rate with unheated skin supernatants. Further investigations led the author to report that certain burned skin extracts were capable of protecting 84% of mice when injected before or with "burn toxin." Normal skin extracts failed to protect the experimental animals.

The final scientific session was classified as a symposium on the design of burn units. There were five contributors to this topic and an additional three papers on a closely related subject. All presentations were essentially illustrated descriptions of various special burn treatment units or centers with comments outlining the background, philosophy, purpose, etc. Two papers were also descriptive and discussed the concept of isolation of the patient within a plastic unit (such as the Life-Island). The final paper was a resumé of the research potential in studying the micro-climate of the burn surfaces under the ideal conditions provided in special treatment units. The papers of this session do not lend themselves to specific summarization. Contributors were:

Planning a burn institute, by Dr. C.P. Artz (Univ. of Texas Medical School, Galveston, Texas)

The motel concept in burns unit design, by Mr. D. Crockett (St. Luke's Hospital, Bradford, England)

Some experiences in the planning and operation of a modern burn unit, by Mr. J. Watson (Queen Victoria Hospital, East Grinstead, England)

Design of a new burn unit, by Mr. J.E. Laing (Plastic Surgery Centre, Odstock Hospital, Salisbury, England)

New burn unit at Wakefield, by Mr. T. Barclay (85 Chevet Lane, Sandal, Wakefield, England)

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Total hospital isolation: the use of a plastic isolator in the control of cross infection, by Dr. B.W. Haynes (Medical College of Virginia, Richmond, Va.)

The use of whole body and partial body isolators, Dr. S. Levenson (Albert Einstein College of Medicine, New York, N.Y.)

The micro climate of the burn surface, by Mr. I.F.K. Muir (Lyneard, The Green, Croxley Green, Rickmansworth, England)

During the two General Meetings of the Congress, there was considerable discussion regarding the formation of a Permanent International Group for Burns. After much deliberation, it was decided that an International Society for Burns should be established. A broad delineation of function and organization was discussed and agreed on and a steering committee was formed. The Secretariat is centered at the Royal College of Surgeons, Nicolson Street, Edinburgh, Scotland. The position of Secretary is filled by the energetic and capable A.B. Wallace. The US is represented by Dr. C.P. Artz (Univ. of Texas Medical School, Galveston, Texas). Interested readers may obtain additional information from either source.

I am sure each delegate is looking forward to meeting in Czechoslovakia in 1970 to attend and participate in the Third International Congress for Research in Burns.

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